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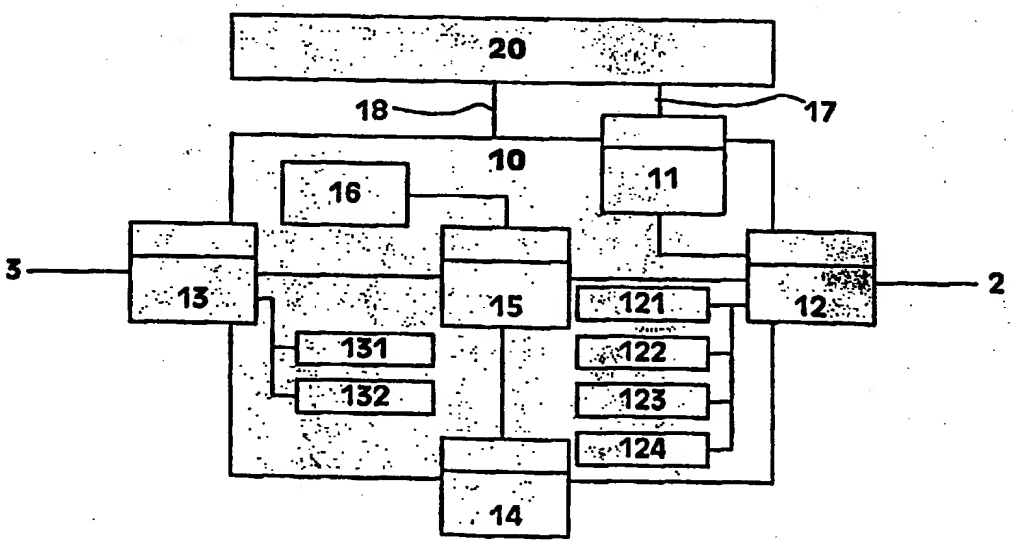

(57) Abstract

A system for setting up at least one media path for a media stream in at least one network (2, 3) comprises a media device (10) in at least part of said media path. Said media device (10) is controlled by a media controller (20). The media device is capable of controlling said part of the media path and its interaction with the media stream at least nearly autonomously under control of the media controller. A method controls the media device in terms of separate resources (11–16, 121–124, 131, 132), which represent functional components within the media device (10), and connections between resources. The media path is created and maintained by joining relevant resources and connections and setting relevant properties of the relevant resources. In software for carrying out the method, one or more of the resources and connections are represented in terms of separate, substantially encapsulated objects having properties. These resources and connections are controlled by setting the relevant properties of the associated objects.

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System for setting up at least one media path for a media stream as well as a method and software for controlling a media device.

The present invention relates to a system for setting up at least one media path for a media stream in at least one network, comprising a media device which comprises at least part of said media path, which media device, during operation, is controlled by a media controller. The invention moreover relates to a method of controlling a media device carrying at least one media stream in at least one media path in at least one network and to software for carrying out said method. Within the scope of the present invention the term *media stream* relates to any kind of information, being in analogue or digital form, like for instance voice, audio, video and data or ant combination of thereof.

Systems and methods of this kind are widely used in telecommunication and computer related applications where there is a need to exchange a media stream between devices connected to a network. The devices may be connected to the same network or to different networks, which moreover may be of different type. An example is for instance a subscriber connected to a packet network as commonly applied in a computer network environment, for instance an IP or ATM network, and a subscriber connected to the public telephone network, which could be an analogue or digital switched circuit network. In order to set up a media path, in this case a voice path, between both subscribers a media device is used to interface between both types of networks. In this example the media device would typically be a gateway device, but many other applications may be envisaged within the scope of the present application requiring a different kind of media device.

In known systems of the kind referred to in the opening paragraph the entire functioning of the media device, including its physical connections, echo cancellers, bridges, network convertors and the like, is more or less directly controlled by the media controller. the media controller is responsible for connection control within the media path as well as for signal control of the media stream carried by the media path. The media gateway merely mediates connections between the circuit switched side and the packet side of the network environment.

A drawback of a system and method of this known kind is that the controller needs to be capable of supporting every type of functionality and every kind of media of the media device. Especially in the field of computers and telecommunication there is a wide variety of possible functions and types of media and even more media applications and network environments are continuously evolving. Accordingly the command set of the controller needs to be quit extensive and moreover this command set should continuously be checked for compliance with newly developed applications and in necessary upgraded . This presents a considerable barrier to the upscalability of these known system and method.

The present invention has for its object to provide for a system and method of the kind referred to in the opening paragraph in which this disadvantage of the known system and method is counteracted.

To this end a system of the type referred to in the opening paragraph is characterized in that the media device is capable of controlling said part of the media path and its interaction with the media stream at least nearly autonomously under control of the media controller. Different from the prior art system and method, the controller is no longer responsible for directly controlling the media stream and all hardware involved. In stead this control is left to the media device itself, which accordingly may need to be more intelligent. The controller may merely keep connection control on a rather general level. As such the media device may be treated by the controller as more or less encapsulated or self-contained unit which is capable of taking care of the further execution of commands issued by the controller. How these commands are really implemented is the responsibility of the media device. Accordingly the command set of the controller need only contain rather general commands which are less prone to change than the lower level control of the media stream and associated hardware itself. As a consequence the controller software may well be capable of already supporting a lot of future expansions in the system.

In a specific embodiment the system is according to the invention characterized in that the media device comprises one or more of physical connections and media processors capable of operating on the media stream. The media processor may be a pipe processor which accepts the media stream and outputs the media stream in another form or with added content, like for instance an echo canceller a codec transcoder or a noise suppressor, but the media processor may also be an end processor which terminates the media stream like for instance a tone player, DTMF detector or a media bridge. In practice it will be possible to create and control a wide variety of different media paths based on merely these components in a system according to the invention.

In a further specific embodiment the system according to the invention is characterized in that at the media device is capable of controlling several media streams over several media paths and in that the controller is capable of controlling several media devices. Within this system, the media device behaves like a single functional entity which is capable of setting up and maintaining more than one media path involving one or more media streams. The media controller merely controls the media device which in turn implements and controls the desired functionality by means of its functional components.

To facilitate control of the media device by the media controller, a further specific embodiment of the system according to the invention is characterized in that the controller and a media device are mutually connected via a control interface for exchanging commands from the controller and control information from the media device. The control information issued by the media device may for instance comprise acknowledgements of control commands received from the controller or status indication of the media stream like the quality of service and events like DTMF-tone detected, connection broken and the like. The controller may react to such control information by issuing suitable commands to the media device.

In a preferred embodiment the system according to the invention is characterized in that the control interface comprises a command buffer for storing commands from the

controller at least temporarily. If the media device is not ready yet to process commands coming from the media controller, these commands may conveniently be stored in the command buffer for later execution. A further preferred embodiment of the system according to the invention is further characterized in that the control interface comprises separate command buffers for different media paths through the media device. Because of the allocation of a separate buffer for each media path through the media device, it may be avoided that a congestion in one of the media paths adversely affects the proper operation of another media path.

A further specific embodiment of the system according to the invention is characterized in that the media device is a media gateway capable of interconnecting a first network and at least one further network, comprising a first connection for said first network and a further connection for each further network as well as means for creating a connection path for passage of the media stream between said connections. The principle function of such a media gateway is to mediate between a connection to the first network and a connection to each further network. These connections might be capable of taking care of any necessary signal conversion, echo cancellation, content adding and the like by themselves, as may be required. Consequently the media gateway may be controlled by the media controller on a rather general level void of any details about network protocols and types of the different networks thereby interconnected.

The media device may issue control information about the status of the media stream and the media path upon request of the media controller, but may also autonomously issue indications of events which have been noticed by the media device, or at least one of its components. Such an indication may be passed to the media controller for further action, like for instance restoring a connection which has broken down. Alternatively a specific embodiment of the system according to the invention is characterized in that the media device comprises a scripting processor capable of performing tasks or issuing commands in response to a signal from another resource. A scripting processor can catch events sent from certain resources and act on them for instance by issuing commands to resources or by issuing new events to the controller. This will save control

traffic between the media controller and the media device and reduces the load on the media controller. Moreover, the scripting processor may be used to add functionality to the media device. As such the scripting processor will allow the low level functionality of the resources in the media device to be aggregated to more complex activities.

A further preferred embodiment of the system according to the invention is characterized in that the system comprises a primary controller for controlling said media device and at least one further controller and in that said further controller is capable of taking over at least part of the control of the media device. The further controller not only adds redundancy to the system, which may be used as a back up facility for the primary controller in case of a malfunction, but offers additional capacity as well so that for instance part of the control of the resources may be passed over to a further controller once the primary controller threatens to overload.

The system according to the invention is based on the basic recognition that upscalability and compliance of the system to future developments may be improved by providing control over the media device on a rather general level, leaving the more detailed interaction with the media stream and the control of the hardware involved as much as possible over to the media device itself. In order to operate such a system, the invention moreover provides for a method as referred to in the opening paragraph, which according to the invention is characterized in that the media device is controlled in terms of separate resources, which represent functional components within the media device interacting with the media stream in said media path, and connections between resources, and in that the media path is created and maintained by joining relevant resources and connections and setting relevant properties of the relevant resources. The protocol used in this method treats the media device as a collection of rather general functional resources and connections that connect these resources, which may be joined or modified to obtain the desired functionality. As such there does not need to be any reflection within the protocol of the real hardware which is represented by these resources. This resembles the desired operation within the system of the invention in which the exact implementation of an action requested by the controller is more or less

hidden for the controller and dealt with on a lower level of the media device or even any component of the media device. Accordingly this method is very suitable for use with the system according to the invention.

In a specific embodiment the method according to the invention is characterized in that the resources comprise first resources representing physical connections of the media device within or beyond the same network and second resources representing processing means which, during operation, operate on a media stream which is carried by the media device. It turns out that a protocol defining just these resources as ingredients is suitable to cover a wide variety of media devices conceivable in one or more networks. In each instance the media device can be modelled in terms of a suitable combination of resources which represent physical connections and processing means together with the associated connections for linking the physical connections to each other.

To implement not only the creation of a media path but also the desired functionality, a further specific embodiments of the method according to the invention is characterized in that at least one of the resources is capable of autonomously performing at least one specific action and in that a command is invoked on said resource to execute said action. The request for said action may come from anywhere in the media device or may have been issued by a common media controller responsible for the control of the media device.

In a preferred embodiment, the method according to the invention is characterized in that the connections between resources are set up to be unidirectional. Defining the connections as being unidirectional provides the largest degree of flexibility. In this way it is possible to support different capabilities in each direction, for instance encoding and encryption. Moreover a unidirectional connection facilitates use of the available resources as efficiently as possible by allocating different numbers of connections to each direction adjusted to the required capacity in the specific direction. A media path requiring a large bandwidth in one direction, whereas only a limited bandwidth is

required in the other direction, can be devised just that way in this preferred embodiment.

In a further preferred embodiment the method according to the invention is characterized in that resources and connections associated with a same media stream are organized into a session, that each resource and each connection is uniquely identified, at least within said session, by a resource identifier and a connection identifier respectively, and in that all said resources and connections are commonly identified by a common session identifier. Such an organization of resources allows to address each resource and connection individually based on the specific resource identifier and connection identifier respectively. On the other hand, the common session identifier may be used to address all the resources and connections involved with that session simultaneously. This is useful if the same command needs to be invoked on all resources and connections of a session, like for instance in case the session is concluded and all resources may be released and in case a session is transferred from one controller to another. Addressing the different resources and connections in those cases by their common session identifier reduces control traffic to the media device.

A further special embodiment of the method according to the invention is characterized in that the media device is controlled by means of control commands which specify at least the session identifier of the applicable session. The media device may for instance be a gateway device bridging different networks, an interactive voice response system, a network access server a multipoint processor unit or the like. The method according to the invention makes it possible to address the media device as a single functional unit, which may be capable of running several sessions over several media paths. Although several sessions may be running within the media device, the control commands according to this embodiment of the method according to the invention can nevertheless be directed to the right resources as each control command specifies the session to which it relates.

A further specific embodiment of the method according to the invention is characterized in that the control commands are combined into control messages which are sent to the media device. Accordingly each message is made up of a number of commands. A sequence of related commands form together a transaction. Messages may contain commands relevant to several concurrent transactions and concurrent sessions within the media device. As such it is possible to effect the exchange of control messages in an efficient manner in the form of a stream of data packages. A identifier associated with each command will later on facilitate a proper routing of the different commands to the resources which need to be addressed.

The control messages may be carried over a reliable or unreliable connection. To be on the safe side an unreliable connection is assumed in a further specific embodiment of the method according to the invention which is characterized in that the media device is requested to acknowledge the receipt of control commands on a session by session basis. As acknowledgement is performed per session, the status of a transaction for that session is immediately apparent.

The invention further relates to software for implementing the method according to the invention, which software is characterized in that one or more of the resources and connections are represented in terms of separate, substantially encapsulated objects having properties and in that said one or more resources and connections are controlled by setting the relevant properties of the associated objects. More particularly the software according to the invention is characterized in that at least one method is defined for at least one of the objects which method represents an action to be performed by the resource represented by said object. This software may conveniently be object oriented, at least to a certain, degree which very well matches the protocol underlying the method of the invention. The self contained nature or encapsulation of the objects in a object oriented programming environment very well resembles the autonomous behaviour of the resources and the media device in accordance with the method and system of the invention. Moreover the same characteristic of an object

oriented programming environment, makes it rather easy to add additional resources and functionality to the method.

The invention will know be described in more detail with reference to a specific example and an associated drawing. In the drawing

figure 1 shows a schematic representation of the basic architecture of a system according to a specific embodiment of the invention; and

figure 2 shows a schematic decomposition of the media device used in the system of figure 1 into functional modules.

Throughout the drawing, similar parts are denoted by the same reference numerals as much as possible.

The generic architecture of a system for setting up at least one media path 1 for a media stream in at least one network 2,3. The media stream may consist of any kind of information like voice, video or data and more types of media may be carried at the same time through the system. The media path is formed by a number of resources which are combined into a media device 10 which is being controlled by a media controller 20.

The media device in this example constitutes a gateway which bridges a connection 21 to the first network 2 to a connection 31 in the second network 3. As such it performs media mapping and transcoding functions. In this case the first network is a switched circuit network (SCN), like a public telephone network and the second network is a packet based network, like a computer network based on the Internet Protocol (IP) or the Asynchronous Transfer Mode (ATM) protocol. The gateway is capable of mapping or transcoding media streams from the SCN network 2 into the packet network 3 and vice versa. Any other kind of combination of existing or future network environments or even more network connections to the same gateway may be envisaged within the scope of the present invention.

The media controller 20 controls the overall state of one or more media streams which are carried by one or more media paths 1 through the media gateway 10. It maps SCN 2 signalling and call control information into the packet network 3 call state and control information. The controller 20 comprises a signalling interface 21 for communication with other signalling components. The controller 20 contains all connection control logic for controlling the gateway 10.

The media gateway 10 is in principal controlled by one primary media controller 20 but a further media controller 25 is standing by. The further media controller 25 provides back up in case of a malfunction of the primary controller 20, but also increases the total control capacity. Should the media gateway 10 discover that the primary controller 20 does not respond within a prescribed time interval on messages or heartbeat indications, the media gateway 10 may conclude that the primary controller 20 is out of service and the further controller 25 takes over the control of the gateway 10. Alternatively a gatekeeper 30, which performs authentication, authorization and call routing in the packet network 3 may transfer the control over the gateway from the primary controller 20 to the further controller 25 and back.

A signalling gateway 40 is connected to the SCN network 2 that terminates SS7 or other signalling links. In general the signalling gateway 40 maintains merely sufficient information about the call state to manage the protocol interface. After processing the incoming SCN signalling data the signalling gateway delivers this information to the appropriate media controller 20,25 which at that moment has control of the gateway 10. Alternatively the signalling gateway 40 could pass the signalling information to several media controllers 20,25 to make efficient use of the SS7 interface.

According to the invention the media gateway 10 is decomposed in distinct functional resources as depicted in figure 2. The gateway is considered to be made up of a number of these resources 11-16,121-124,131,132 which are connected and controlled to make up a media path through the gateway. Different types of resources may be distinguished, namely a first type 11-14 which represent external physical connections of the media

device to the outside world, which may for instance be a common network or different networks, and a second type of resources 15,16,121-124,131,132 which represent processing means which operate on the media stream but do not directly connect to the outside world. The first type of resources may be referred to as edge points to distinguish them from the second type, hereinafter referred to as media resources.

The gateway of figure 2 comprises four such edge points 11-14. The first edge point 11 provides for a signalling back haul between the gateway 10 and the media controller 20. For some applications it may be necessary to terminate some of the signalling channel on the media gateway 10 rather than on the media controller 20. To do so, either the media gateway must back haul signalling to the media gateway controller or it must interwork the signalling protocol itself. Given that generally the media controller will have to take care of certain signalling control anyway, like for instance non-facility associated SS7 signalling, signalling control is back hauled to the controller in this case. This is facilitated by the first edge point 11 which connects to a signalling control channel 17 between the controller 20 and gateway 10.

A second edge point 12 provides a media interface with a switched circuit network 2. The second edge point is capable of converting a media stream on a SCN bearer channel to a Real-Time Transport Protocol scheme and vice versa to provide a bridge to a IP based packet network 3 connected to a third edge point 13. To provide additional functionality a number of further resources 121-124 are connected to the second edge point 12, including a echo canceller 121, a DTMF tone detector 122, a DTMF tone generator 123 and a announcement player 124 or even more or other devices. Likewise the third edge point 13 has been provided with a codec device 131 and a music source 132 as additional resources. In terms of control software the edge points may be modelled into objects having i.a. a resource identifier, a connection type and several parameters specifying the desired operation of the resources associated with the edge point. These properties may be set to include or exclude one or more of these added resources. Due to the nature of a phone system, edge points which connect to a public

telephone network will be bidirectional, whereas edge points to an IP based packet network will generally be unidirectional.

The gateway moreover comprises a fourth edge point 14 for connection to an ATM packet network. Not all of the resources are required to be supported in all media gateways. This allows media gateways to be tailored to a specific application. As such the fourth edge point 14 has not been implemented in the example of figure 1 and 2.

Beside the edge points 11-14 the gateway comprises a media resource in the form of a bridge 15 which interconnects the several edge points 11-14 and a control interface with the controller 20, which includes a control channel 18 as well as several command buffers which are not explicitly indicated in the figure.

The resources 11-16,121-124,131,132 are connected to form connections that mostly operate unidirectional so it is possible to support different capabilities in each direction, like for instance encoding, encryption and available bandwidth. Multiple connections make up a session. A session is a generic representation of a call or conference etc. So a call is a session and a conference call is similarly one session. A point to point voice session is made up of two unidirectional voice connections, a point to point multimedia session comprises a number of voice, video and data connections, a multipoint conference session is made up of multiple unidirectional connections and a multicast session involves a number of unidirectional connections that connect to a multicast stream, e.g. multicast IP addresses and multicast ATM VCs. Each connection is identified by a connection identifier, the ConnectionID, which is unique within a session. Also the resources involved in the session will have a resource identifier which is unique within the session in order to be unambiguously addressable.

The session state of each session is maintained in the controller 20. Multiple gateways may be involved in a single session and a session may encompass media streams of different type, for instance audio, video and data. A gateway on the other hand may be involved in more than one session at a time. A session is identified by a session

identifier, the Sesion ID. If a controller controls resources on multiple gateways which form part of a single session, then the SessionID will be the same for all gateways. In terms of software a session may be reflected by a session object which contains the SessionID and a list of its connections.

Resources are interconnected by specifying the ResourceID of the appropriate resources as sender and receiver of media. Within the system of the invention the gateway is sufficient intelligent to combine the resources and to perform transcoding if necessary. Bridging functionality, as depicted in figure 2, but also legal interception, conferencing and the like is performed entirely autonomously by the gateway. A join command to an existing connection will signify the desire to join a running session, whereas an optional BridgeType parameter allows the type of bridging to be specified.

According to the method of the invention the media gateway is controlled in terms of these resources, which are representative of functional modules and edge points of the media gateway, and their associated connections. Within this concept resources may have different kinds of functionality indicated as parameters, actions and events. Parameters are semi-static values which are relevant for the resource. A parameter can be set upon creation of the resource, like codec type and IP address, or left open. If parameters are left unspecified by the controller, a default value may be used or the gateway may fill in an appropriate value itself and communicate that to the controller.

Connected resources can perform actions on request from the controller, like playing a DTMF tone for a certain time. On the other hand resources may generate events on the occurrence of a specific event to trigger action on other resources or the controller. For instance an edge point may generate an event in response to a remote connection being lost, or the quality of service value on a RTCP connection falling below a certain threshold or a DTMF detector may raise an event in response to the detection of a DTMF-tone. Although each resource can have all this functionality within the scope of the present invention it should be noticed that not all of this functionality need to be supported for every resource. In terms of control software for carrying out the method,

the resources may be modelled as resource objects in an object oriented programming environment, the parameters being represented by properties of the specific object and the actions and events being implemented by means of methods associated with the objects.

A scripting processor 16 is a special resource that can catch events sent by certain resources and react on them by issuing commands to the same or other resources or by generating new events and directing these to the controller. The scripting resource is a very advantageous part of the operation of the media gateway as it allows the low level functionality of the resources to be aggregated to more complex activities. An example would be to play a message, collect digits, play another message, collect more digits, as required in some existing applications. At the operation level of resources this would require a lot of commands or method calls and a lot of events being sent. The scripting processor is capable of avoiding this all by taking over the burden. In this way the scripting processor 16 can be used to reduce the amount of communication between the controller and the gateway and the load the session will impose on the controller. The scripting processor may have its own language, like Java, Perl or Python or even a specially developed proprietary instruction set.

Control of the gateway takes place by means of the exchange of control messages between the media controller 10 and the gateway 20 via the control interface including the control line 18. each message may consist of a number of commands. A sequence of related commands make up a transaction. Messages may contain commands for several concurrent transactions within concurrent sessions. In order to be able to route the different commands to the applicable sessions, each command will be accompanied by a sessionID. Moreover a send sequence number and a receive sequence number will be included in order to provide for a unambiguous acknowledgement by the gateway to the controller that a command has been received properly. Since an unreliable connection is assumed, all messages are explicitly acknowledged. Acknowledgement is performed on a session by session basis. If desired the control messages may be encrypted to add security.

There are four basic commands to control the media gateway, referred to as Connect, Modify, Delete and Query. By means of the conect command new connections are created or additions are made to existing connections.

Connect can be used to create a connection with multiple branches in a single command. The connections created with this command are unidirectional. The first End Resource in the command is the source of the connection and the rest of the command describes the media path downstream. The connect command creates a new session if a new sessionID is given, otherwise the new connection will be added to the existing session specified. Each connect command creates a new connection in that session.

Modify is the command from the controller to the gateway to change a resource or the parameters of a resource within the gateway. If a resourceID is specified the parameters of that resource are modified.

Delete is the command from the controller to the gateway to delete a session, connection or resource within the gateway. Deleting a resource will free it so that it may be used in another connection.

The query command is used to retrieve all kinds of information from the gateway, like the stae of the gateway, of a specific session or of specific resources within the gateway. In general the command will allow wild carding where convenient and safe.

Besides these commands more specific commands may be added to completely tune the behaviour of the gateway by the controller. All commands are cast in a general form without any reflection of the specific hardware which is addressed. The latter is left over to the media gateway itself which autonomously takes care of the requested functionality. In this manner the controller may control a wide variety of gateway architectures and other media devices with only a limited instruction set, only little prone to modification as time passes and new applications, functionality and media devices are required.

Although the invention has been elucidated in detail with respect to merely a single example, it will be appreciated that the invention is by no means limited to the example given. On the contrary a skilled person will be able to devise several variations and modification without departing from the inventive scope of the present invention. As such it should be noticed that the invention is not only applicable to controlling a gateway between an SCN-network and a packet network, but may as well be employed for other media devices such as:

- trunking gateways that interface between SCN networks and a Voice over IP network, typically interfacing to SS7 or other NNI signalling on the SCN network and managing a large number of digital circuits;
- voice over ATM gateways, which operate much the same way as voice over IP trunking gateways, except that they interface to an ATM network;
- access gateways, that interface UNI interfaces like ISDN (PRI and BRI) and traditional analogue voice terminal interfaces to a Voive over IP network;
- residential gateways, being access gateways for a small number of voice terminals that can be allocated with a cable modem or set top box;
- network access servers, that convert modem signals from an SCN network and provide data access to a packet network;
- multipoint control units, that provide multipoint connectivity between terminals on SCN and packet networks; and
- interactive voice response systems, that provide automatic voice response and switching services in response to DTMF signals from the SCN network.

The resources described in the example may be extended with further resources to meet the requirements of the different media devices, like for instance a DTMF filter, a tone player, a message player, a message recorder, a transcoder module, an encryption module, a decryption module, a master bridge, a bridge front end, an in band signalling detector, an in band signalling generator and the like as may be required. Each time the media device can be modelled and controlled using the tools presented by the present invention.

Claims:

1. A system for setting up at least one media path for a media stream in at least one network, comprising a media device which comprises at least part of said media path, which media device, during operation, is controlled by a media controller, characterized in that the media device is capable of controlling said part of the media path and its interaction with the media stream at least nearly autonomously under control of the media controller.

2. A system according to claim 1 characterized in that the media device comprises one or more of physical connections and media processors capable of operating on the media stream.

3. A system as claimed in claim 1 or 2 characterized in that at the media device is capable of controlling several media streams over several media paths and in that the controller is capable of controlling several media devices.

4. A system as claimed in claim 3 characterized in that the controller and a media device are mutually connected via a control interface for exchanging commands from the controller and control information from the media device.

5. A system as claimed in claim 4 characterized in that the control interface comprises a command buffer for storing commands from the controller at least temporarily.

6. A system as claimed in claim 5 characterized in that the control interface comprises separate command buffers for different media paths through the media device.

7. A system as claimed in claim 3, 4, 5 or 6 characterized in that the media device is a media gateway capable of interconnecting a first network and at least one further

network, comprising a first connection for said first network and a further connection for each further network as well as means for creating a connection path for passage of the media stream between said connections.

8. A system as claimed in claim 3, 4, 5, 6 or 7 characterized in that the media device comprises a scripting processor capable of performing tasks or issuing commands in response to a signal from another resource.

9. A system as claimed in anyone of the preceding claims characterized in that the system comprises a primary controller for controlling said media device and at least one further controller and in that said further controller is capable of taking over at least part of the control of the media device.

10. A system as claimed in anyone of the preceding claims characterized in that the media device is capable of triggering an internal component in order to serve a command from the controller.

11. A system as claimed in anyone of the preceding claims characterized in that the media device comprises encryption means capable of encrypting the media stream.

12. A method of controlling a media device carrying at least one media stream in at least one media path in at least one network, characterized in that the media device is controlled in terms of separate resources, which represent functional components within the media device interacting with the media stream in said media path, and connections between resources, and in that the media path is created and maintained by joining relevant resources and connections and setting relevant properties of the relevant resources.

13. A method as claimed in claim 12 characterized in that the resources comprise first resources representing physical connections of the media device within or beyond

the same network and second resources representing processing means which, during operation, operate on a media stream which is carried by the media device.

14. A method as claimed in claim 12 or 13 characterized in that at least one of the resources is capable of autonomously performing at least one specific action and in that a command is invoked on said resource to execute said action.

15. A method as claimed in claim 12, 13 or 14 characterized in that at least one of the resources is capable of autonomously issuing an indication signal upon the occurrence of a specific event.

16. A method as claimed in anyone of claims 12 to 15 characterized in that the connections between resources are set up to be unidirectional.

17. A method as claimed in anyone of claims 12 to 16 characterized in that resources and connections associated with a same media stream are organized into a session, that each resource and each connection is uniquely identified, at least within said session, by a resource identifier and a connection identifier respectively, and in that all said resources and connections are commonly identified by a common session identifier.

18. A method as claimed in claim 17 characterized in that the media device is controlled by means of control commands which specify at least the session identifier of the applicable session.

19. A method as claimed in claim 18 characterized in that the control commands are combined into control messages which are sent to the media device.

20. A method as claimed in claim 18 or 19 characterized in that the media device is requested to acknowledge the receipt of control commands on a session by session basis.

21. Software for carrying out the method of anyone of claims 12 to 20 characterized in that one or more of the resources and connections are represented in terms of separate, substantially encapsulated objects having properties and in that said one or more resources and connections are controlled by setting the relevant properties of the associated objects.

22. Software according to claim 21 characterized in that at least one method is defined for at least one of the objects which method represents an action to be performed by the resource represented by said object.

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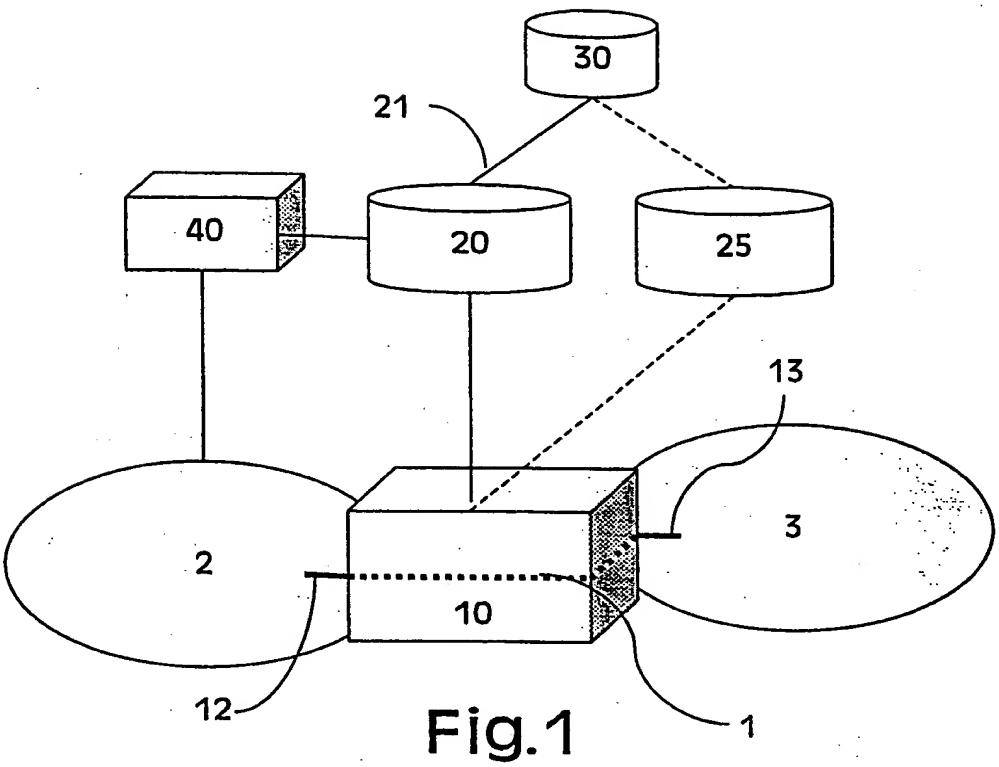
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Fig.1

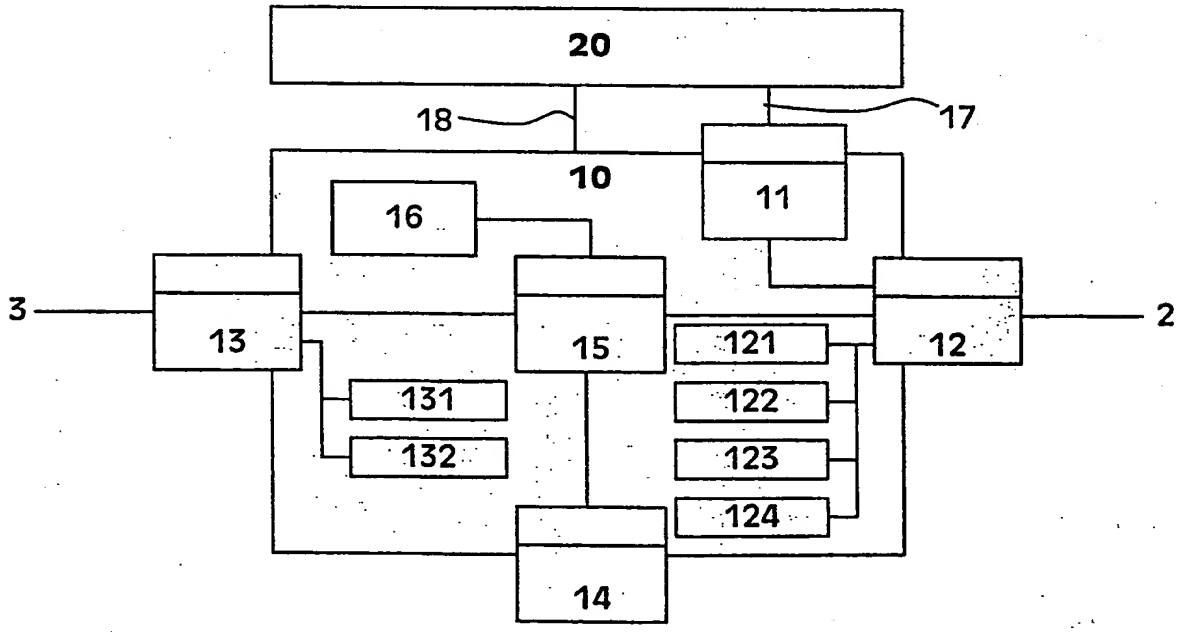
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Fig.2

INTERNATIONAL SEARCH REPORT

Int. Ional Application No
PCT/EP 99/09027

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q11/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q H04L H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	RUEFFLER D ET AL: "A SMART NODE ARCHITECTURE LINKING TELEPHONY WITH THE INTERNET" PROCEEDINGS OF INTERNATIONAL CONFERENCE ON COMPUTER COMMUNICATION,ÄS.L.Ü: ÄS.NÜ, vol. CONF. 13, 1997, pages 77-81, XP000753882 ISBN: 2-7261-1104-1	1,2, 12-14
Y		11,21
A	figures 1,2 page 78, left-hand column, line 19 -page 79, left-hand column, line 59	3-10, 15-20

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[X] Further documents are listed in the continuation of box C. [ ] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 February 2000	03/03/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Scalia, A

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INTERNATIONAL SEARCH REPORT

Int. Ional Application No
PCT/EP 99/09027

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	HOUGHTON T F ET AL: "A PACKET TELEPHONY GATEWAY FOR PUBLIC NETWORK OPERATORS" ISS. WORLD TELECOMMUNICATIONS CONGRESS. (INTERNATIONAL SWITCHING SYMPOSIUM),CA,TORONTO, PINNACLE GROUP, 1997, pages 35-44, XP000704453	11
A	figures 4,5 page 39, right-hand column, line 20 -page 40, right-hand column, line 31 page 43, left-hand column, line 13 - line 55	1,12
Y	ELWALID A I ET AL: "AN OVERVIEW OF THE MULTIMEDIA COMMUNICATIONS EXCHANGE (MMCX) AND ITS PERFORMANCE CHARACTERIZATION" BELL LABS TECHNICAL JOURNAL,US,BELL LABORATORIES, vol. 2, no. 2, 21 March 1997 (1997-03-21), pages 15-34, XP000695167 ISSN: 1089-7089	21
A	page 21, left-hand column, line 1 -page 22, left-hand column, line 2	22

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